

410 Rec'd PCT/PTO 09/647081
26 SEP 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
REQUEST FOR FILING NATIONAL PHASE OF
PCT APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

To: Asst. Commissioner of Patents and Trademarks
Washington, D.C. 20231
(Our Deposit Account No. 03-3975)

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)

Atty Dkt: PM 273843 /T298020US
M# /Client Ref.

From: Pillsbury Madison & Sutro LLP, IP Group:

Date: September 26, 2000

This is a **REQUEST** for **FILING** a PCT/USA National Phase Application based on:

- | | | |
|--|---|---|
| 1. International Application
PCT/FI99/00247
country code | 2. International Filing Date
25 MAR 1999
Day MONTH Year | 3. Earliest Priority Date Claimed
27 MAR 1998
Day MONTH Year
(use item 2 if no earlier priority) |
|--|---|---|
4. Measured from the earliest priority date in item 3, this PCT/USA National Phase Application Request is being filed within:

(a) ☐ 20 months from above item 3 date (b) ☒ 30 months from above item 3 date,

(c) Therefore, the due date (unextendable) is September 27, 2000

Title of Invention METHOD OF TRANSMITTING SYNCHRONIZED CHANNEL IN RADIO TRANSMITTER

Inventor(s) RANTALAINEN, Timo et al

Applicant herewith submits the following under 35 U.S.C. 371 to effect filing:

☒ Please immediately start national examination procedures (35 U.S.C. 371 (f)).

☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)) is transmitted herewith (file if in English but, if in foreign language, file only if not transmitted to PTO by the International Bureau) including:

- a. ☐ Request;
b. ☐ Abstract;
c. pgs. Spec. and Claims;
d. sheet(s) Drawing which are ☐ informal ☐ formal of size ☐ A4 ☐ 11"

☒ A copy of the International Application has been transmitted by the International Bureau.

A translation of the International Application into English (35 U.S.C. 371(c)(2))

- a. ☒ is transmitted herewith including: (1) ☒ Request; (2) ☒ Abstract;
(3) 15 pgs. Spec. and Claims;
(4) 5 sheet(s) Drawing which are:
☐ informal ☒ formal of size ☒ A4 ☐ 11"
- b. ☐ is not required, as the application was filed in English.
c. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
d. ☐ Translation verification attached (not required now).

534 Rec'd PCT/PTC 26 SEP 2000

RE: USA National Filing of PCT/FI99/00247

11. ☒ **PLEASE AMEND** the specification before its first line by inserting as a separate paragraph:
 a. ☒ --This application is the national phase of international application PCT/FI99/00247 filed March 25, 1999 which designated the U.S. --
 b. ☐ --This application also claims the benefit of U.S. Provisional Application No. 60/____, filed ____.
12. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., **before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**
13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau
14. ☐ Translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., of **claim amendments** made before 18th month, is attached (required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled).
15. **A declaration of the inventor** (35 U.S.C. 371(c)(4))
 a. ☐ is submitted herewith ☐ Original ☐ Facsimile/Copy
 b. ☒ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
16. **An International Search Report (ISR):**
 a. Was prepared by ☐ European Patent Office ☐ Japanese Patent Office ☒ Other
 b. ☒ has been transmitted by the international Bureau to PTO.
 c. ☒ copy herewith (2 pg(s).) ☒ plus Annex of family members (1 pg(s)).
17. **International Preliminary Examination Report (IPER):**
 a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.
 b. ☒ copy herewith in English.
 c.1 ☒ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:
 c.2 ☒ Specification/claim pages #12-15 claims # 1-28
 Dwg Sheets #
 d. ☒ Translation of Annex(es) to IPER (required by 30th month due date, or else annexed amendments will be considered canceled).
18. **Information Disclosure Statement** including:
 a. ☒ Attached Form PTO-1449 listing documents
 b. ☒ Attached copies of documents listed on Form PTO-1449
 c. ☒ A concise explanation of relevance of ISR references is given in the ISR.
19. ☐ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.
20. ☐ Copy of Power to IA agent.
21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): ____ sheet(s) per set ☐ 1 set informal;
☐ Formal of size ☐ A4 ☐ 11"
22. ☐ ____ (No.) **Verified Statement(s)** establishing "small entity" status under Rules 9 & 27
23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) **FINLAND** of:

	Application No.	Filing Date		Application No.	Filing Date
(1)	980704	27 MAR 1998	(2)	_____	_____
(3)	_____	_____	(4)	_____	_____
(5)	_____	_____	(6)	_____	_____

 a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, please proceed promptly to obtain same from the IB.
 b. ☐ Copy of Form PCT/IB/304 attached.

RE: USA National Filing of PCT/FI99/00247

534 Rec'd PCT/PTO 26 SEP 2000

24. Attached: FINNISH OFFICE ACTION AND NOTIFICATION OF THE RECORDING OF A CHANGE

25. Preliminary Amendment:

25.5 Per Item 17.c2, cancel original pages # _____, claims # _____, Drawing Sheets # _____26. Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☒ 17, ☐ 25, ☐ 25.5 (hilitte)

Total Effective Claims	28	minus 20 =	8	x \$18/\$9	= \$	966/967
Independent Claims	2	minus 3 =	0	x \$78/\$39	= \$	964/965
If any proper (ignore improper) Multiple Dependent claim is present,				add \$260/\$130	+	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ BASIC FEE REQUIRED, NOW →→→→ ↓

A. If country code letters in item 1 are not "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA"

See item 16 re:

1. Search Report was <u>not</u> prepared by EPO or JPO -----	add \$970/\$485	960/961
2. Search Report was prepared by EPO or JPO -----	add \$840/\$420	970/971
	+970	

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA" ↓

→ <input type="checkbox"/> B. If USPTO did not issue <u>both</u> International Search Report (ISR) <u>and</u> (if box 4(b) above is X'd) the International Examination Report (IPER), -----	add \$970/\$485	+0	960/961
→ <input type="checkbox"/> C. If USPTO issued ISR but not IPER (or box 4(a) above is X'd), -----	add \$690/\$345	+0	958/959
→ <input type="checkbox"/> D. If USPTO issued IPER but IPER Sec. V boxes <u>not all</u> 3 YES, -----	add \$670/\$335	+0	958/957
→ <input type="checkbox"/> E. If international preliminary examination fee was paid to USPTO and Rules 492(a)(4) and 496(b) <u>satisfied</u> (IPER Sec. V <u>all</u> 3 boxes YES for <u>all</u> claims), -----	add \$96/\$48	+0	962/963

27. SUBTOTAL = \$970

28. If Assignment box 19 above is X'd, add Assignment Recording fee of ----\$40 +0 (581)

29. Attached is a check to cover the ----- TOTAL FEES \$970

Our Deposit Account No. 03-3975

Our Order No. 60256

273843

C#

M#

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.

This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed

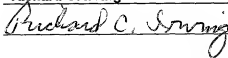
Pillsbury Madison & Sutro LLP
Intellectual Property Group

1100 New York Avenue, NW
 Ninth Floor
 Washington, DC 20005-3918
 Tel: (202) 861-3000
 Atty/Sec: RCI/sdm

By Atty: Richard C. Irving

Reg. No. 38499

Sig:



Fax: (202) 822-0944
 Tel: (202) 861-3788

NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

09/647081

534 Rec'd PCT/PTO 26 SEP 2000

APPLICATION UNDER UNITED STATES PATENT LAWS

Atty. Dkt. No. PM 273843

(M#)

Invention: METHOD OF TRANSMITTING SYNCHRONIZED CHANNEL IN RADIO TRANSMITTER

Inventor (s): RANTALAINEN, Timo
 RUUTU, Ville
 ALANEN, Marko
 GUNNARSON, Gudni
 HYVARINEN, Olli

Pillsbury Madison & Sutro LLP
 Intellectual Property Group
 1100 New York Avenue, NW
 Ninth Floor
 Washington, DC 20005-3918
 Attorneys
 Telephone: (202) 861-3000

This is a:

- ☐ Provisional Application
- ☐ Regular Utility Application
- ☐ Continuing Application
☐ The contents of the parent are incorporated by reference
- ☒ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification
Sub. Spec Filed _____
 in App. No. _____ / _____
- ☐ Marked up Specification re
Sub. Spec. filed _____
 In App. No. _____ / _____

SPECIFICATION

METHOD OF TRANSMITTING SYNCHRONIZED CHANNEL IN RADIO
TRANSMITTER

FIELD OF THE INVENTION

- The invention relates to a method of transmitting a synchronized
5 channel in a radio transmitter, where normal radio bursts are transmitted on a
normal channel asynchronously.

BACKGROUND OF THE INVENTION

- Cellular radio networks comprise applications which require that a
subscriber terminal or some other corresponding radio receiver receives
10 synchronized radio signals from various base stations. Such applications
include different methods of locating subscriber terminals. An example of such
locating methods is an OTD (Observed Time Difference) method based on
time differences detected in the reception of signals. In this method a terminal
equipment measures differences in times of arrivals of signals transmitted by
15 base stations. The method requires that the base stations transmit signals at
the same moment, in other words synchronously, or otherwise data is required
on the differences in synchronization (Real Time Difference, RTD) between
the base stations if the base stations are not synchronized. The location is
carried out based on this data. This method is described in greater detail in
20 Finnish Patent Application 954,705.

- Several systems, such as the GSM system, are not synchronized or
they are not synchronized sufficiently accurately so that the signals could be
used in the location according to the OTD method. In the GSM system, normal
channels are divided both on a time division (TDMA, time division multiple
25 access) and frequency division (FDMA, frequency division multiple access)
basis. A radio transmitter thus uses a specific time slot on a predetermined
frequency for transmitting a normal physical channel. In the GSM system, the
base stations transmit radio bursts of a normal channel asynchronously, which
means that the transmissions between the base stations are not coordinated
30 such that each base station would transmit a radio burst simultaneously.
Further, the aforementioned synchronization differences between the base
stations change over time. Therefore the OTD method cannot be used for
location without continuous measurement of the synchronization differences.
Measurement of the synchronization differences produces more signalling and
35 causes additional error in the accuracy of the location.

- One suggested solution is to synchronize all the radio transmitters with each other by means of a satellite-based locating system (global positioning system, GPS), in which case a GPS receiver would be installed at each base station. This arrangement may cause problems in the GSM system
- 5 since the system utilizes hierarchical clocks. This means that a base station controller guiding a base station obtains timing from higher network elements and delivers it to the base stations. If a GPS receiver were used for the timing of the base station transmission, the entire timing of the GSM system would be confused.

10 BRIEF DESCRIPTION OF THE INVENTION

- An object of the invention is to develop a method and an apparatus implementing the method which solve the aforementioned problems. This is achieved with a method of the type described in the introduction, which is characterized by obtaining synchronized timing;
- 15 synchronized radio bursts, the length of which is at most half of the length of a normal radio burst; transmitting a synchronized radio burst in the place of a normal radio burst such that the transmission of the synchronized radio burst is synchronized with the obtained synchronized timing.

- The invention also relates to a radio transmitter comprising a
- 20 channel codec for forming a normal channel; a burst former for forming normal radio bursts; a multiplexer for assigning to each burst the moment for its transmission.

- The radio transmitter according to the invention is characterized in that it also comprises a clock for obtaining synchronized timing; the channel
- 25 codec is arranged to form a synchronized channel; the burst former is arranged to form synchronized radio bursts, the length of which is at most half of the length of a normal radio burst; the multiplexer is arranged to insert a synchronized radio burst in the place of a normal radio burst such that the transmission of the synchronized radio burst is synchronized with the obtained
- 30 synchronized timing.

The preferred embodiments of the invention are disclosed in the dependent claims.

- A basic idea of the invention is that a radio burst normally used by a radio transmitter is at least halved so that the obtained synchronized radio
- 35 burst can always be inserted flexibly in the place of the normal radio burst. The expression 'in the place of' means that the normal radio burst is replaced in

principle, i.e. the burst that is to be actually transmitted is not necessarily replaced but the synchronized burst is transmitted during the time slot in which it would be possible in principle to transmit the normal radio burst.

- The method and the radio transmitter according to the invention
- 5 provide several advantages. Synchronized signals can be transmitted to a receiver without a need to make any changes in the general timing structure. For example the GSM system does not require changes in the TDMA frame structure. The structure of the synchronized signals can be optimized according to the needs of the intended use, such as a locating method.

10 BRIEF DESCRIPTION OF THE FIGURES

In the following the invention will be described in greater detail in connection with preferred embodiments, with reference to the accompanying drawings, in which

- Figure 1 shows an example of the structure of a cellular radio
- 15 network employing the invention,

Figure 2 shows the structure of a transceiver,

Figure 3 shows synchronized radio bursts according to the invention and the moments when they are transmitted at four different base stations,

- Figure 4 shows two different alternatives of transmitting a
- 20 synchronized radio burst in the place of a normal radio burst,

Figure 5 shows the structure of a synchronized radio burst,

Figures 6 and 7 are flowcharts illustrating the implementation of the method according to the invention,

- Figure 8 shows the positioning of a synchronized radio burst with
- 25 padding bits in the place of a normal radio burst.

DETAILED DESCRIPTION OF THE INVENTION

- The invention can be used in different radio transmitters. The examples describe the use of the invention in a cellular radio network. With
- 30 reference to Figure 1, the structure of a typical cellular radio network will be described. Figure 1 only contains the blocks that are essential for explaining the invention, but it is clear for those skilled in the art that a conventional cellular radio network also comprises other functions and structures, which do not have to be described in greater detail herein. The examples describe a

cellular radio network employing time division multiple access (TDMA) without restricting the invention thereto, however.

A cellular radio network typically comprises a fixed network infrastructure, i.e. a network part 128, and subscriber terminals 150, which may be fixed, located in a vehicle or portable hand-held terminal equipments. The network part 128 comprises base stations 100. Several base stations 100 are controlled in a centralized manner by a base station controller 102 communicating with them. A base station 100 comprises transceivers 114. A base station 100 typically comprises 1 to 16 transceivers 114. For example in the TDMA radio system, one transceiver 114 typically provides radio capacity for one TDMA frame, i.e. eight time slots.

The base station 100 comprises a control unit 118, which controls the operation of the transceivers 114 and a multiplexer 116. The multiplexer 116 places the traffic and control channels used by several transceivers 114 onto a single transmission link 160.

The transceivers 114 of the base station 100 have a connection to an antenna unit 112, which realizes a bidirectional radio link 170 to a subscriber terminal 150. The structure of frames to be transmitted on the bidirectional radio link 170 is accurately determined and it is referred to as an air interface.

Figure 2 shows in greater detail the structure of a transceiver 114. The functions at the reception will be described first. A receiver 200 comprises a filter blocking frequencies outside a desired frequency band. A signal is thereafter converted onto an intermediate frequency or directly to baseband, and the signal in this form is sampled and quantized in an A/D converter 202.

An equalizer 204 compensates for interference caused by multipath propagation, for example. A demodulator 206 extracts from the equalized signal a bit stream, which is transferred to a demultiplexer 208. The demultiplexer 208 separates the desired part from the received bit stream into logical channels. This function is based on the structure of the received bit stream, which consists of radio bursts placed in time slots, forming a physical channel.

A channel codec 216 decodes bit streams of different logical channels, i.e. it decides whether a bit stream consists of signalling data, which is transmitted to a control unit 214, or speech, which is transmitted 240 to a speech codec 122 in the base station controller 102. The channel codec 216

decodes possible channel coding, such as block coding and convolutional coding, deinterleaves possible interleaving, and decrypts the encryption used over the radio path.

The control unit 214 carries out internal control tasks by controlling
5 different units mainly on the basis of control received from the base station controller 102.

The functions at the transmission will be described next. The data to be transmitted is channel-coded, interleaved and encrypted in the channel codec 216. A burst former 228 adds a training sequence and a tail to the data
10 arriving from the channel codec 216. A multiplexer 226 assigns to each burst its physical channel. A modulator 224 modulates digital signals onto a radio frequency carrier. This function is analogous, wherefore it requires a D/A converter 222.

A transmitter 220 comprises a filter restricting the bandwidth. The
15 transmitter 220 also controls the output power of the transmission. A synthesizer 212 provides different units with required frequencies. The synthesizer 212 comprises a clock, which may be locally controlled or controlled in a centralized manner from some other place, for example the base station controller 102. The synthesizer 212 creates the necessary
20 frequencies by means of a voltage-controlled oscillator, for example.

As shown in Figure 2, the structure of the transceiver can further be divided into radio-frequency parts 230 and a digital signal processor with its software 232. The radio-frequency parts 230 comprise the receiver 200, the transmitter 220 and the synthesizer 212. The digital signal processor with its
25 software 232 comprises the equalizer 204, the demodulator 206, the demultiplexer 208, the channel codec 216, the control unit 214, the burst former 228, the multiplexer 226 and the modulator 224. Conversion of an analogue radio signal into a digital signal requires an A/D converter 202 and, correspondingly, the conversion of a digital signal into an analogue signal
30 requires a D/A converter 222.

The base station controller 102 comprises a group switching field 120 and a control unit 124. The group switching field 120 is used for switching speech and data and for connecting signalling circuits. The base station 100 and the base station controller 102 form a base station system 126, which also
35 comprises a transcoder 122. The distribution of functions between the base station controller 102 and the base station 100 as well as their physical

structure may vary in different implementations. The base station 100 typically manages the implementation of the radio path as described above. The base station controller 102 typically manages the following things: configuration of traffic channels, frequency hopping control, paging of subscriber terminals, power control, quality control of active channels, and handover control.

The transcoder 122 is usually located as close to a mobile services switching centre 132 as possible, because this allows speech to be transmitted between the transcoder 122 and the base station controller 102 in a cellular radio network form, which saves transmission capacity. The transcoder 122 converts different digital speech coding modes used between a public switched telephone network and a radio phone network to make them compatible, for example from a 64 kbit/s fixed network form to another form (such as 13 kbit/s) of the cellular radio network, and vice versa. The control unit 124 performs call control, mobility management, gathering of statistical data, and signalling.

As shown in Figure 1, a circuit-switched connection can be set up from the subscriber terminal 150 to a telephone 136 connected to the public switched telephone network (PSTN) 134 via the mobile services switching centre 132. The cellular radio network may also employ a packet-switched connection, for example 2+ phase packet transmission, i.e. GPRS (General Packet Radio Service), of the GSM system.

The structure of the subscriber terminal 150 can be described by means of the representation of the structure of the transceiver 114 shown in Figure 2. The structural elements of the subscriber terminal 150 are functionally identical to those of the transceiver 114. The subscriber terminal 150 also comprises a duplex filter between the antenna 112 and the receiver 200 and the antenna and the transmitter 220, user interface parts and a speech codec. The speech codec is connected to the channel codec 216 via a bus 240.

Figure 3 shows how transmissions of four different base stations BTS 1, BTS 2, BTS 3, BTS 4 are not synchronized with each other. Each base station transmits its normal bursts NB at instants that differ randomly from one another. According to the invention, each base station receives timing, which is described in Figure 3 by successive bursts SYNCHRONIZED BURSTS.

Timing is received from a clock, which is for example a GPS receiver 180

connected to the control unit 118 of the base station 100 as shown in Figure 1. The control unit 118 forwards the received timing to the transceivers 114.

In the invention, a special synchronous channel is formed in the channel codec 216. In principle the synchronous channel is placed on a normal physical channel. The number of physical channels available is a compromise. For example in the OTD locating method, the more frequently synchronous signals are transmitted the more often the subscriber terminal 150 is able to receive them and to carry out more measurements, which improves the accuracy of the location. On the other hand, this consumes more traffic capacity of the system. The example shown in Figure 3 utilizes one frequency, i.e. all the eight time slots of one TDMA frame, i.e. eight physical traffic channels. If the traffic capacity is to be consumed as little as possible, only one time slot can be used to transmit synchronized bursts, for example time slot 'one' of a broadcast control channel (BCCH), in which case the subscriber terminal 150 always knows the location of the synchronized bursts after it has received one normal synchronization channel burst (SCH). In order that the capacity of an uplink physical channel corresponding to a downlink synchronized channel would not be wasted, the capacity can be used to forward signalling data, such as measurement results of the subscriber terminal 150, to the base station 100.

A preferred embodiment utilizes the normally unused capacity for transmission of synchronized radio bursts. For example when a radio transmitter is in a mode of discontinuous transmission (DTX) and no normal radio bursts are being transmitted, it is possible to transmit instead synchronized radio bursts, on the basis of which the subscriber terminal 150 is able to determine its location, for example.

Another method of making the operation more effective is to transmit synchronized radio bursts by means of only a part of the capacity of a physical channel. In such a situation the synchronous bursts are repeated according to a predetermined sequence, for example in every third time slot of the physical channel.

The physical channel to be used for transmitting the synchronized channel can be indicated to the subscriber terminal 150 on a control channel, such as the broadcast control channel (BCCH).

The burst former 228 is arranged to form synchronized radio bursts SB. The length of a synchronized radio burst SB is at most half of the

length of a normal burst NB in order that the synchronized burst SB can always be inserted in the place of the normal burst NB. The multiplexer 226 is arranged to insert the synchronized radio burst SB in the place of the normal radio burst NB in such a way that the transmission of the synchronized burst

5 SB is synchronized with the timing obtained from the clock 180.

Figure 3 shows timing in the form of possible synchronized bursts SYNCHRONIZED BURSTS. A vertical line has been drawn from the start and end of each such burst to describe the instant a synchronous burst SB can be transmitted at each base station BTS 1 TIMING, BTS 2 TIMING, BTS 3

10 TIMING, BTS 4 TIMING. The synchronized bursts SB transmitted by each base station start and end at exactly the same instant.

It can be seen from Figure 3 that in a preferred embodiment the timings happen to match at base station BTS 1, whereupon two synchronized bursts SB can be transmitted in the place of a normal burst NB. The burst

15 former 228 is arranged to form successive synchronized bursts SB, which the multiplexer 226 inserts in the place of the normal burst NB since they fit there. On the other hand, this embodiment can also be avoided if receiving two synchronized bursts during one time slot causes problems in the subscriber terminal 150, in which case only one of the synchronized bursts is transmitted.

20 At base station BTS 2, the timings differ from one another exactly half a time slot, and therefore it is possible to transmit two synchronized bursts SB in the place of the normal burst NB.

However, in the most common situation the timing obtained by the base station 100 from the network and the timing obtained from the clock 180

25 do not match. In such a case it is possible to transmit only one synchronized burst SB in the place of the normal burst NB as shown in Figure 3 with base stations BTS 3 and BTS 4. As the figure shows, every other synchronous burst SB would extend to two normal bursts NB, which is not desirable.

Figure 5 illustrates the structure of a synchronized burst SB. In the

30 same way as a normal burst a synchronized burst must also comprise tail bits TB both at the beginning and end of the burst. These bits are used during a guard period when the transmitter increases the power to the required transmit power and thereafter lowers it to the idle state. The tail bits are usually set to zero.

35 As shown in Figure 4, a synchronized burst SB can be inserted in the place of a normal burst NB in two different manners. The first manner is

shown in the middle in the figure. The synchronized burst SB shown therein is a special burst of Figure 5, the length of which is at most half of the normal burst NB. Nothing else is transmitted in this time slot besides the synchronized burst SB.

- 5 The second manner is illustrated in Figure 4 at the bottom. The burst former 228 is arranged to form a burst that is equal in length to a normal radio burst NB, and a synchronized burst SB is inserted therein. The part of the formed burst that does not belong to the synchronized burst SB is filled with predetermined padding bits PAD. This embodiment provides an
10 advantage that the transmission time of the burst does not have to be changed, but only the content thereof is altered.

- As shown in Figure 5, the synchronized burst SB comprises at least a predetermined bit pattern TS. Usually this bit pattern is a training sequence which is also known to the receiver and which can be searched in
15 the equalizer 204. By comparing this known training sequence to the signal that is actually received it is possible to estimate what kind of distortions have accumulated in the signal over the radio path. When the receiver receives the synchronized burst SB it also obtains accurate timing, since the transmission moment of the burst is determined to be the same at different base stations,
20 unlike in the case of normal bursts NB. For the purpose of locating methods the structure of a known bit pattern can be optimized suitably.

- In a preferred embodiment a synchronized burst also comprises other information INFO as shown in Figure 5. The information may contain the location coordinates COORD of the base station 100. Timing offset OFFSET
25 can also be transmitted in the information field INFO. In this case the offset refers to the time difference between the transmission moments of the ideal synchronized radio burst and the actual synchronized radio burst. In reality, the transmission moment of the synchronized burst SB can be adjusted with the accuracy of maybe only one bit or one fourth of a bit, in which case the
30 offset indicates the difference from the exact correct transmission moment. The information may further include other information OTHER INFO, and the information can also be combined $\text{COORD} + \text{OFFSET}$ in a desired manner.

- To obtain the most accurate possible timing the training sequence TS should be as long as possible. Therefore some or even all of the
35 information INFO can be transferred to padding bits PAD, so that the training sequence TS can be continued to the place of the information INFO. Since the

position of the synchronized burst SB varies, sometimes the information INFO would be placed before and sometimes after the synchronized burst SB. In such a case the subscriber terminal 150 must be able to select the correct place from which the information INFO is decoded.

- 5 Figure 8 shows how a synchronized radio burst SB is inserted with padding bits PAD in the place of a normal radio burst NB. This figure illustrates the implementation of the alternative shown lowermost in Figure 4. The tail bits TB are naturally situated at the beginning and end of the burst. They are followed by padding bits PAD, which surround the training sequence TS and
- 10 the information INFO.

The invention is preferably implemented by means of software and it requires changes in an accurately restricted area of the software of the digital signal processor 232 in the transceiver 114 of the base station 100. The invention further requires that a radio transmitter obtains synchronized timing

15 for example from the clock 180.

The implementation of the method according to the invention in a radio transmitter is further illustrated with reference to the flowcharts of Figures 6 and 7. The method starts in block 600. In block 602 the method proceeds to the next time slot. In block 604 it is checked whether the logical channel to be

20 transmitted in the time slot is normal or synchronized. In block 606 normal radio bursts are transmitted asynchronously on a normal channel. In block 608, a synchronized burst formed according to the invention is transmitted. In block 610 it is checked whether the method is to be continued. If not, the execution of the method is terminated in block 612. If it is continued, the

25 process proceeds to block 602, where the processing of the next time slot is started.

Block 608 is described in greater detail in Figure 7. The implementation begins in block 700. Synchronized timing is obtained in block 702. Next, it is checked in block 704 whether it is time to transmit a

30 synchronized burst. If not, the process moves back to block 702 where the clock is checked. This is repeated until it is time to transmit the synchronized burst. When it is detected after the checking carried out in block 704 that it is time to transmit a synchronized burst, the method proceeds to block 706. In block 706 it is checked whether a sufficient part of the time slot is left for the

35 transmission of the synchronized burst. If not, the method proceeds to block 712. If a sufficient part of the time slot is left, the process moves to block 708

where synchronized radio bursts SB are formed, the bursts having a length of at most half of the length of a normal radio burst. Next, in block 710 the synchronized radio burst is transmitted in the place of a normal radio burst such that the transmission of the synchronized burst is synchronized with the
5 obtained synchronized timing. The last step is block 712 where the execution of block 608 is terminated.

Even though the invention is described above with reference to the example according to the accompanying drawings, it is clear that the invention is not restricted thereto but it can be modified in several ways within
10 the scope of the inventive idea disclosed in the appended claims.

ART 34 AMDT

12

CLAIMS 10.5.2000

1. A method of transmitting synchronized channels in at least two radio transmitters, where normal radio bursts are transmitted (606) on a normal channel asynchronously, **characterized by**

5 (702) obtaining synchronized timing;

(708) forming synchronized radio bursts (SB), the length of which is at most half of the length of a normal radio burst;

(710) transmitting synchronized radio bursts in the place of normal radio bursts such that the transmission of the synchronized radio bursts is synchronized with the obtained synchronized timing.

2. A method according to claim 1, **characterized by** forming at least two successive synchronous radio bursts (SB), at least one of which is transmitted.

3. A method according to claim 1, **characterized by** placing at least one synchronized radio burst (SB) in a burst having the length of a normal radio burst.

4. A method according to claim 3, **characterized in that** the part of the burst that does not belong to the synchronized radio burst (SB) consists of predetermined padding bits (PAD).

5. A method according to claim 1, **characterized in that** the synchronized radio burst (SB) comprises a predetermined bit pattern (TS).

6. A method according to claim 5, **characterized in that** the bit pattern is a training sequence.

7. A method according to claim 1, **characterized in that** the synchronized radio burst (SB) comprises information (INFO), such as the location coordinates (COORD) of the radio transmitted and/or the offset (OFFSET), i.e. the time difference between the transmission moments of the ideal synchronized radio burst and the actual synchronous radio burst.

8. A method according to claim 1, **characterized by** placing the radio burst in a time slot.

9. A method according to claim 1, **characterized in that** the synchronized channel is transmitted by means of at least one normal physical channel.

10. A method according to claim 9, **characterized by** indicating on a control channel the physical channels to be used for the transmission of the synchronized channel.

11. A method according to claim 1, **characterized** in that the physical channels in the direction of reception corresponding to the synchronous channel in the direction of transmission are used to transmit signalling information, such as measurement results.

5 12. A method according to claim 1, **characterized** in that the method is used in a locating method, such as the OTD (observed time difference) method.

13. A method according to claim 1, **characterized** in that a synchronized radio burst is transmitted when the radio transmitter is in
10 discontinuous transmission.

14. A method according to claim 1, **characterized** in that the transmission of synchronized radio bursts only employs a part of the capacity of a normal channel.

15 15. A radio transmitter comprising:
a channel codec (216) for forming a normal channel;
a burst former (228) for forming normal radio bursts;
a multiplexer (226) for assigning to each burst the moment for its
transmission;

20 **characterized** in that
it also comprises a clock (180) for obtaining synchronized timing,
which synchronized timing defines the coordination between the transmission
of radio bursts from at least two different base stations (100) comprising each
at least one radio transmitter;

25 the channel codec (216) is arranged to form a synchronized
channel;

the burst former (228) is arranged to form synchronized radio
bursts (SB), the length of which is at most half of the length of a normal radio
burst;

30 the multiplexer (226) is arranged to insert a synchronized radio
burst in the place of a normal radio burst such that the transmission of the
synchronized radio burst is synchronized with the obtained synchronized
timing.

16. A radio transmitter according to claim 15, **character-**
ized in that the burst former (228) is arranged to form at least two
35 successive synchronous radio bursts (SB) and the multiplexer (226) is
arranged to insert at least one of them in the place of a normal radio burst.

17. A radio transmitter according to claim 15, **character-
ized** in that the burst former (228) is arranged to form a burst the length of
which equals the length of a normal radio burst and which comprises at least
one synchronized radio burst (SB).

5 18. A radio transmitter according to claim 17, **character-
ized** in that the burst former (228) is arranged to place predetermined
padding bits (PAD) in the part of the burst that does not belong to the
synchronized radio burst (SB).

10 19. A radio transmitter according to claim 15, **character-
ized** in that the burst former (228) is arranged to place a predetermined bit
pattern (TS) in the synchronized radio burst (SB).

20. A radio transmitter according to claim 19, **character-
ized** in that the bit pattern is a training sequence.

15 21. A radio transmitter according to claim 15, **character-
ized** in that the channel codec (216) is arranged to place in the
synchronized radio burst (SB) information, such as the location coordinates
(COORD) of the radio transmitter and/or the offset (OFFSET), i.e. the time
difference between the transmission moments of the ideal synchronized radio
burst and the actual synchronous radio burst.

20 22. A radio transmitter according to claim 15, **character-
ized** in that the multiplexer (226) is arranged to place the radio burst in a
time slot.

23. A radio transmitter according to claim 15, **character-
ized** in that the channel codec (216) is arranged to use at least one normal
25 physical channel for the synchronized channel.

24. A radio transmitter according to claim 23, **character-
ized** in that the radio transmitter is arranged to indicate on a control channel
the physical channels to be used for the transmission of the synchronized
channel.

30 25. A radio transmitter according to claim 15, **character-
ized** in that the radio transmitter is arranged to receive signalling data, such
as measurement results, from the channels in the direction of reception
corresponding to the synchronous channels in the direction of transmission.

26. A radio transmitter according to claim 15, **character-
35 ized** in that the clock (180) is a GPS receiver.

27. A radio transmitter according to claim 15, **character-
ized** in that the radio transmitter is arranged to transmit a synchronized
radio burst when the transmitter is in discontinuous transmission.

28. A radio transmitter according to claim 15, **character-
5 ized** in that the radio transmitter is arranged to use only a part of the
capacity of a normal channel for the transmission of synchronized radio
bursts.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200

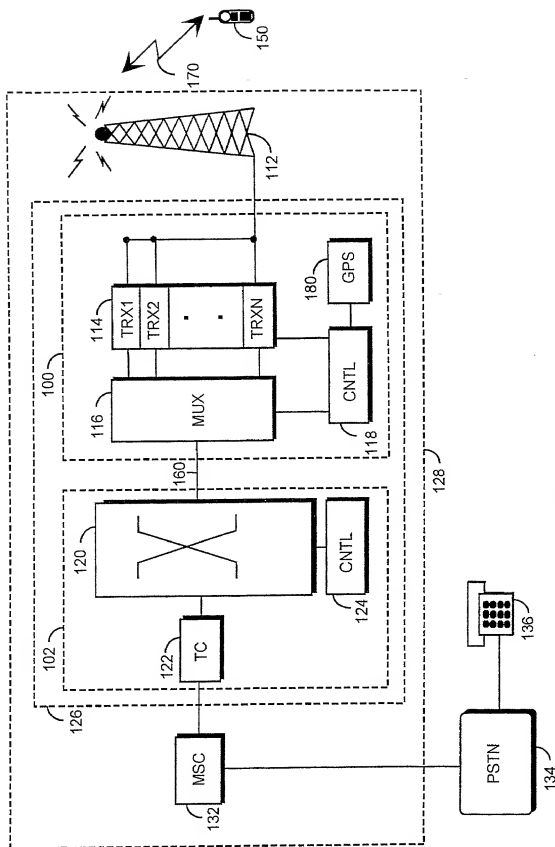


Fig 1

DOCTEE-1804960

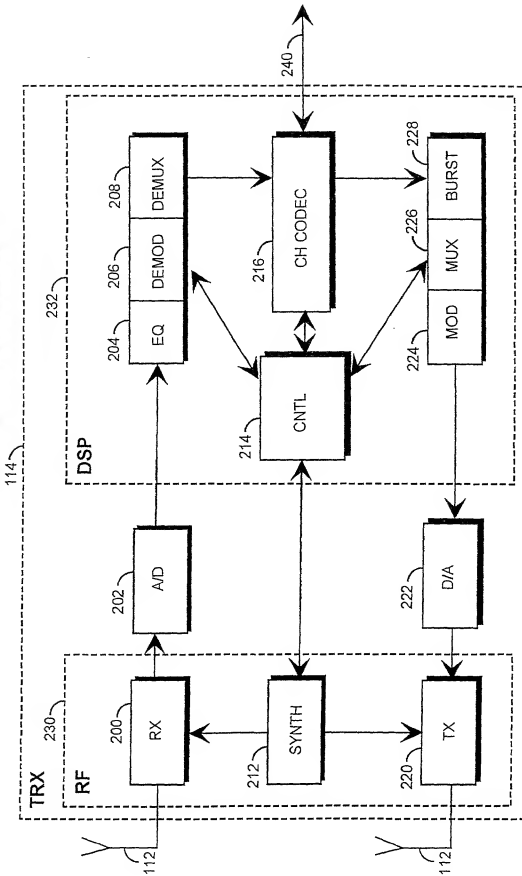


Fig 2

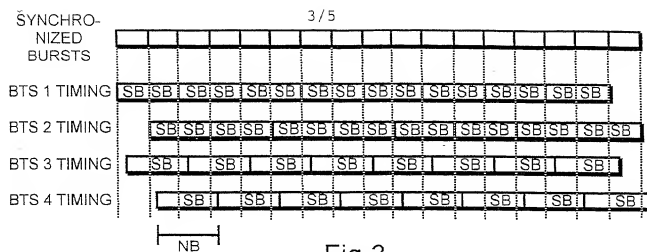


Fig 3

SYNCHRONIZED
BURSTS

BTS
TRANSMISSION

OR

BTS
TRANSMISSION

Fig 4

SB

INFO:

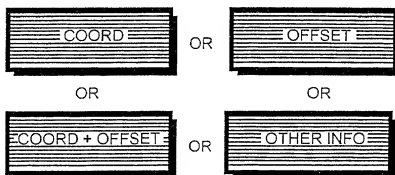


Fig 5



Fig 8

4/5

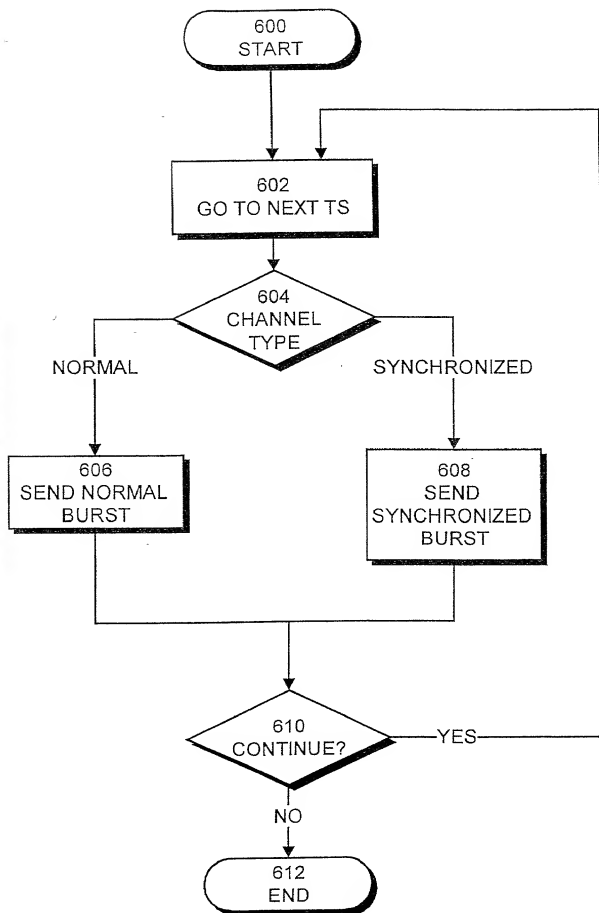


Fig 6

5/5

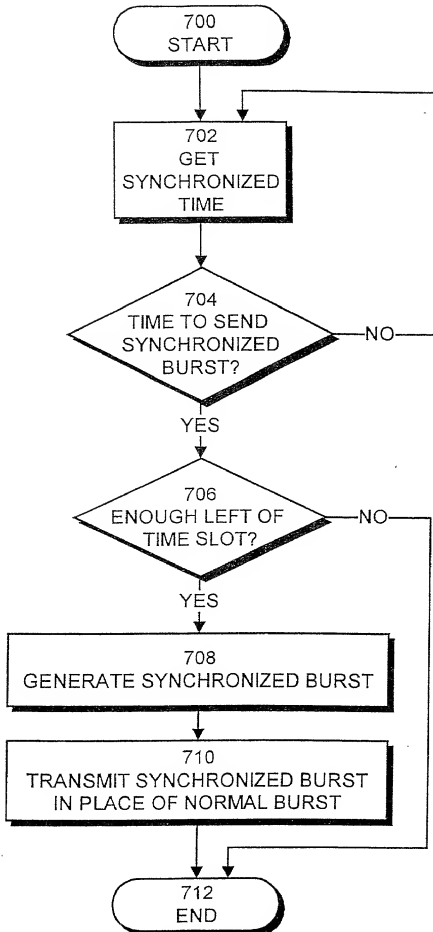


Fig 7

FOR UTILITY/DESIGN
CIP/PCT NATIONAL/PLANT
ORIGINAL/SUBSTITUTE/SUPPLEMENTAL
DECLARATIONS

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PM & S
FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the INVENTION ENTITLED

Method of transmitting synchronized channel in radio transmitter

the specification of which (CHECK applicable BOX(ES))
X ☐ A. ☐ is attached hereto.
BOX(ES) ☐ B. ☐ was filed on _____ as U.S. Application No. _____ /
☒ C. ☐ was filed as PCT International Application No. PCT/ FI99 / 00247 on 25 March 1999
and (if applicable to U.S. or PCT application) was amended on 10 May 2000

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(c) or 356(b) of any foreign applications for patent or inventor's certificate, or 356(a) of any PCT International Application which designated at least one other country than the United States, listed below and also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S)			Date first Laid- open or Published	Date Patented or Granted	Priority Claimed Yes No
Number	Country	Day/MONTH/Year Filed			
980704	Finland	27 March 1998			X

I hereby claim domestic priority benefit under 35 U.S.C. 119(e) or 120 and 365(c) of the indicated United States applications listed below and PCT International applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in the application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S)			Status	Priority Claimed Yes No
Application No. (series code/serial no.)	Day/MONTH/Year Filed		pending, abandoned, patented	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Madison & Sutro LLP, Intellectual Property Group, 1100 New York Avenue, N.W., Ninth Floor, East Tower, Washington, D.C. 20005-3918, telephone number (202) 361-3000 (to whom all communications are to be directed), and the below-named persons (of the same address) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete names/numbers below of persons no longer with their firm and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above firm and/or a below attorney in writing to the contrary.

Paul N. Kokulis	16773	Dale S. Lazar	28972	Mark G. Paulson	30793	Michael R. Dawonczyk	36787
Raymond F. Lippitt	17519	Paul E. White, Jr.	32041	Stephen C. Glazier	31361	W. Patrick Bengtsson	32456
G. Lloyd Knight	17698	Glenn J. Perry	28458	Paul F. McQuade	31642	Jack S. Barufka	37087
Carl G. Love	18781	Kendrew H. Colton	30368	Ruth N. Morduch	31044	Adam R. Hess	41835
Kevin E. Joyce	20508	G. Paul Edgell	24238	Richard H. Zaitlen	27248		
George M. Sirilla	18221	Lynn E. Eccleston	35861	Roger R. Wise	31204		
Donald J. Bird	25323	Timothy J. Kilma	34852	Jay M. Finkelstein	21052		
Peter W. Gowdey	25872	David A. Jakopin	32935	Anita M. Kirkpatrick	32617		

(1) INVENTOR'S SIGNATURE: Timo Rantala Date: 3.10.2000

Timo				RANTALA INEN	
First	Middle Initial			Family Name	
Residence	Helsinki	Finland	Finland	Finland	
City	State/Foreign Country		Country of Citizenship		
Post Office Address	Meripiaistie 4 A 7, FIN-00200 Helsinki, Finland				
(Include Zip Code)					

(2) INVENTOR'S SIGNATURE: Ville Suutari Date: 26.9.2000

Ville				SUUTARI	
First	Middle Initial			Family Name	
Residence	Espoo	Finland	Finland	Finland	
City	State/Foreign Country		Country of Citizenship		
Post Office Address	Tilansuu 2 D 4, FIN-02210 Espoo, Finland				
(Include Zip Code)					

(FOR ADDITIONAL INVENTORS, check box ☒ to attach PAT 116-2 same information for each re signature, name, date, citizenship, residence and address.)

RE: USA National Filing of PCT/FI99/00247

11. ☒ **PLEASE AMEND** the specification before its first line by inserting as a separate paragraph:
 a. ☒ --This application is the national phase of international application PCT/FI99/00247 filed March 25, 1999 which designated the U.S.--
 b. ☐ --This application also claims the benefit of U.S. Provisional Application No. 60/_____, filed _____.
12. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., **before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**
13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau
14. ☐ Translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., of claim amendments made before 18th month, is attached (**required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled**).
15. **A declaration of the inventor** (35 U.S.C. 371(c)(4))
 a. ☐ is submitted herewith ☐ Original ☐ Facsimile/Copy
 b. ☒ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
16. **An International Search Report (ISR):**
 a. Was prepared by ☐ European Patent Office ☐ Japanese Patent Office ☒ Other
 b. ☒ has been transmitted by the international Bureau to PTO.
 c. ☐ copy herewith (2 pg(s).) ☒ plus Annex of family members (1 pg(s)).
17. **International Preliminary Examination Report (IPER):**
 a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.
 b. ☒ copy herewith in English.
 c.1 ☒ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:
 c.2 ☒ Specification/claim pages #12-15 claims # 1-28
 Dwg Sheets # _____
 d. ☒ Translation of Annex(es) to IPER (**required by 30th month due date, or else annexed amendments will be considered canceled**).
18. **Information Disclosure Statement** including:
 a. ☒ Attached Form PTO-1449 listing documents
 b. ☒ Attached copies of documents listed on Form PTO-1449
 c. ☒ A concise explanation of relevance of ISR references is given in the ISR.
19. ☐ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.
20. ☐ Copy of Power to IA agent.
21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): _____ sheet(s) per set: ☐ 1 set informal;
☐ Formal of size ☐ A4 ☐ 11"
22. ☐ _____ (No.) **Verified Statement(s)** establishing "small entity" status under Rules 9 & 27
23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) FINLAND of:

Application No.	Filing Date	Application No.	Filing Date
(1) <u>980704</u>	<u>27 MAR 1998</u>	(2) _____	_____
(3) _____	_____	(4) _____	_____
(5) _____	_____	(6) _____	_____

 a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, **please proceed promptly to obtain same from the IB.**
 b. ☐ Copy of Form PCT/IB/304 attached.

RE: USA National Filing of PCT/FI99/00247

534 Rec'd PCT/PTO 26 SEP 2000

24. Attached: FINNISH OFFICE ACTION AND NOTIFICATION OF THE RECORDING OF A CHANGE

25. **Preliminary Amendment:**25.5 Per Item 17.c2, **cancel original** pages #____, claims #____, Drawing Sheets #26. **Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:**Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☒ 17, ☐ 25, ☐ 25.5 (hilitte)

Total Effective Claims	28	minus 20 =	8	x \$18/\$9	= \$	960/967
Independent Claims	2	minus 3 =	0	x \$78/\$39	= \$	964/965
If any proper (ignore improper)				add \$260/\$130	+	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ BASIC FEE REQUIRED, **NOW** →→→→ ↓A. If country code letters in item 1 are **not** "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA" ↓See item 16 re: ↓

1. Search Report was not prepared by EPO or JPO -----	add \$970/\$485	960/961
2. Search Report was prepared by EPO or JPO -----	add \$840/\$420	970/971
	+970	

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA" ↓

→ <input type="checkbox"/> B. If USPTO did not issue both International Search Report (ISR) and (if box 4(b) above is X'd) the International Examination Report (IPER), -----	add \$970/\$485	+0	960/961
→ <input type="checkbox"/> C. If USPTO issued ISR but not IPER (or box 4(a) above is X'd), -----	add \$690/\$345	+0	958/959
→ <input type="checkbox"/> D. If USPTO issued IPER but IPER Sec. V boxes not all 3 YES, -----	add \$670/\$335	+0	956/957
→ <input type="checkbox"/> E. If international preliminary examination fee was paid to USPTO and Rules 492(a)(4) and 496(b) satisfied (IPER Sec. V all 3 boxes YES for all claims), -----	add \$96/\$48	+0	962/963

27.	SUBTOTAL =	\$970	
28.	If Assignment box 19 above is X'd, add Assignment Recording fee of ---\$40	+0	(581)
29.	Attached is a check to cover the -----	TOTAL FEES	\$970

Our Deposit Account No. 03-3975

Our Order No. 60256

273843

C#

M#

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.

This CHARGE STATEMENT **does not authorize** charge of the issue fee until/unless an issue fee transmittal form is filed

Pillsbury Madison & Sutro LLP
Intellectual Property Group

1100 New York Avenue, NW
 Ninth Floor
 Washington, DC 20005-3918
 Tel: (202) 861-3000
 Atty/Sec: RCI/sdm

By Atty: Richard C. IrvingReg. No. 38499Sig: Richard C. Irving

Fax: (202) 822-0944
 Tel: (202) 861-3788

NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

DECLARATION AND POWER OF ATTORNEY

(continued)

ADDITIONAL INVENTORS:

(3) INVENTOR'S SIGNATURE:

Date: 26.09.2000

Marko		A		ALANEN	
First		Middle Initial		Family Name	
Tampere				Finland	
City		State/Foreign Country		Country of Citizenship	
Post Office Address		Kivistentie 4 E 29 33200 Tampere			
(include Zip Code)					

(4) INVENTOR'S SIGNATURE:

Date: 02.10.2000

Gudni				GUNNARSSON	
First		Middle Initial		Family Name	
ESBO		FINLAND		Iceland	
City		State/Foreign Country		Country of Citizenship	
Post Office Address		VISA KOIVUNKUJA 15 A3, 02130 ESBO			
(include Zip Code)					

(5) INVENTOR'S SIGNATURE:

Date: 29.09.2000

Olli		H. A.		HYVÄRINEN	
First		Middle Initial		Family Name	
Tampere				Finland	
City		State/Foreign Country		Country of Citizenship	
Post Office Address		Vesakontatu 33, 33200 Tampere			
(include Zip Code)					

(6) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial		Family Name	
Residence					
City		State/Foreign Country		Country of Citizenship	
Post Office Address					
(include Zip Code)					

(7) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial		Family Name	
Residence					
City		State/Foreign Country		Country of Citizenship	
Post Office Address					
(include Zip Code)					

(8) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial		Family Name	
Residence					
City		State/Foreign Country		Country of Citizenship	
Post Office Address					
(include Zip Code)					

(9) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial		Family Name	
Residence					
City		State/Foreign Country		Country of Citizenship	
Post Office Address					
(include Zip Code)					